Issue 43
April 2022

Utah Valley Amateur Radio Club

The UVARC Shack

Worked 'em in a winter wonderland

The truck belonging to Carl Pockrus WE7OMG, hauling the UVARC trailer to our Winter Field Day site at the Lindon Marina. Behind the trailer is Carl's Buckmaster OCF antenna, the main SSB antenna for the activity. This year, UVARC exceeded our past record numbers of contacts and points by more than 40%, but time will tell whether we'll take that top spot again.

In this issue of the *UVARC Shack*

Report and photos on a fun Winter Field Day at Lindon Marina.

My Shack spotlights K9GKG. *Amateurs in Action* in the San Gabriel Mountains. *Brass Tacks* on coupling.

Dear Annette answers why we use 2:1 to measure SWR bandwidth, and another about whether there's an A, B, or C ionospheric layer. *Hot Tips* on announcing your call sign. *DIY* for a 6-band Windom antenna. *The Amateur in You* on bands and decibels.

Please send your ideas, stories, questions, gripes, and photos to ***uvarcshack@gmail.com***

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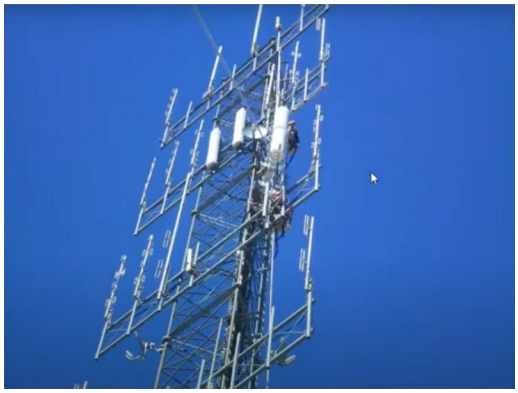
Club meetings

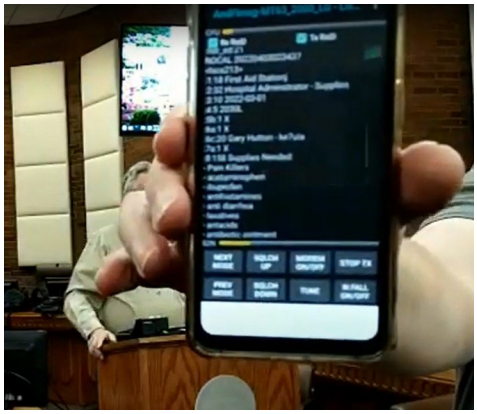
Recap

February 2022 club meeting – Antenna show-and-tell



February's meeting was online this time, and we still had quite the participation. Doug Pelley WB7TUJ called in to our meeting from toasty warm Arizona, and talked with us about (mostly VHF) antennas, and some problems an amateur radio operator might encounter with them. He also showed us a few photos and gave us a kind of "What's wrong with this antenna?" quiz, which was fun. You can see the recording of the meeting here.

March 2022 club meeting – NBEMS



Gary Hutton KE7UIA gave us a terrific presentation on NBEMS (Narrow Band Emergency Messaging Software), a digital mode that you can use without any special equipment except a radio and your phone or laptop. He demonstrated that, once you install the *fldigi* software, NBEMS allows you to digitally send texts that contain pages of information quickly, without cell towers, without repeaters, and without internet. It can come in handy, especially in an emergency, if your radio can connect with another, whether that's locally or far away. You can see the recording of the meeting here.

By the way, many of our past meetings are recorded and posted on the club YouTube channel.

My Shack

Highlighting the shack (ham equipment and room) of a member, to give others an idea of the possibilities that might work for them

Gavin Grow, K9GKG

When I was a kid, I saw my grandfather's radio and thought to myself, "That radio is too complicated." When I was in high school, I got into CB radios with my friends. That was a lot of fun. For years I would go on campouts with the Boy Scouts. Countless times I would be out of range from cell towers. I often thought to myself, "What would I do if I needed first aid and I couldn't communicate with my cell phone?" and "How could I communicate with other leaders if I can't use my cell phone?" I began looking for a back-up solution. In 2019, I found my solution while viewing an emergency preparedness video. I began searching the internet for more information about ham radios and their capabilities. The more I looked into it, the more I realized I had found much more.

My path to getting a license wasn't traditional. I think I went about it the hard way; if I had to do it over again, I would have asked around for someone who knew amateur radios. I would probably have taken classes through UVARC or UCARES. While searching on my own, I found it very helpful to buy a radio and listen to it before I got my license. Lastly, finding an Elmer was one of the best ways to learn amateur radio.

Getting my license was an experience of its own. I was so happy the day I passed that I completely forgot it was my wife's birthday. I felt like a 16-year-old kid who just got his driver's license. Luckily, by 1:30 that afternoon, I finally realized what day it was.

I've had my license for almost two years now. I enjoy rubbing elbows with other hams who know far more than me. I've also had the opportunity to help Noji teach some classes during the Pandemic. I found that joining in with multiple nets like the New Ham Net, UCARES, CERT, and the Sultans of Simplex has been a great way to practice. Another fun activity I enjoy doing is participating in the communications for the Provo Half Marathon and the Springville Parade. These are great ways to learn how to function in a realistic net situation. I strongly recommend participating in these kinds of summer events.

I often monitor the UVARC repeater while scanning other frequencies when mobile. It's been fun getting to meet so many of you. I hope to hear you on the radio soon.

Gavin has been our Net Control for the New Ham Net a few times, and can be seen at many club meetings and other UVARC events.

— Gavin Grow, K9GKG

Amateurs in Action

Recounts of ham radio operators who have used their time and skills to help others in a time of need

Rescue in the San Gabriel Mountains

It was a quiet afternoon on 11 July 2009, and Rich Lippucci KI6RRQ (now NI6H), of Vista, California, was monitoring a local repeater from his home station. *I heard someone come over the repeater, calling, "Is anybody listening?" I responded and the caller said he was on his handheld hiking around the Mt. Baldy area. He said a few hikers had arrived from farther in the backcountry, and one of their friends had broken an ankle and was a mile or more up the trail and needed help.*

Rich Lippucci KI6RRQ, monitoring

The caller, Kirk Gustafson KE6MTF, said there was no cell service where they were. He had an approximate idea of where he was, but he did have GPS coordinates. Lippucci called 911 and was transferred three times.

Dispatch coordinated the rescue with the San Bernardino Fire Department who sent a foot patrol to the area, he said. The Sherriff's office dispatched a helicopter to the hiker, who was now stabilized, but they did not feel they could land, due to the steep terrain, so they performed a tether rescue. About fifteen minutes of arriving, the chopper airlifted the 40-year-old woman out successfully.

Kirk said, *When I got out of my car to start the hike, I grabbed my handheld radio and GPS. My friends told me "That's just extra weight – you won't need that." I told them, "I go nowhere without my radio.' I don't think they will say that next time!* Kirk said that some of them decided they need to look into getting ham radio licenses too.

Lippucci said that ham radio saved the day. *This is such an excellent example of the benefits of ham radio, when cell and landlines were unavailable. If they had to hike out of the wilderness, get to their cars, and find a cell signal, they might have been pushing up against the loss of daylight hours. Any rescue would have been significantly more difficult in the dark.*

The terrain necessitated a tether rescue

Lippucci said that 911 and the Sherriff's office in San Bernardino accepted the ham radio call without hesitation. *They used a ham radio operator to relay questions to Kirk through me, to gain all the information they needed to put assets on the emergency*, he said. *It was as if I was calling about something in my own backyard, even though the problem was several counties away in the mountains, with people I didn't know. I am proud to have had the opportunity to use my license in service of an emergency situation. As a CERT member, this was the very reason I got my ham radio license in the first place!*

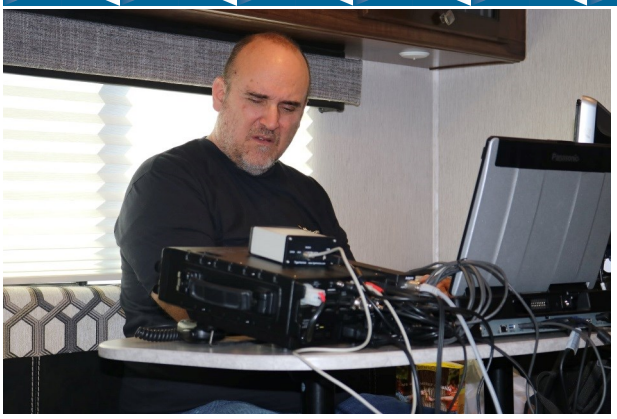
You can read Rich's story on the ARRL website and in *QST* October 2013, page 87.

Winter Field Day

In photos

Winter Field Day

In photos



Winter Field Day

In photos

New Hams and Upgrades

New hams

KK7DIU = Bryan Cardon
KK7DJF = Nick Simpson
KK7DJG = Steven Humes
KK7DJT = Ambrose Killpack
AI7LD = Evan Dodson
K3DPZ = Darrell Duty
KK5ASD = Angie Duty
KK7DRV = Kenneth Abel
AJØEY = Joey Anderson
KK7DRX = Mike Dunn
KK7DRY = Isaiah Price
KK7DRZ = David Ulibarri
KK7DWH = Kirstin Bybee
KK7DWJ = Jared Dugger
KK7DWL = Andrew Howell
KK7DWM = Paul Hughes
KK7DWN = Luke Ludeman
KK7DWQ = Jared Patterson
KK7DWR = Dan Schilaty
KK7DWU = Ben Willardson
KK7DYN = Joseph Dominguez
KK7EBG = Todd Turner
KK7ECH = Sean Wheelhouse
KK7EDB = Yasunori Iwata
K1DBW = Douglas Weaver
KK7EGX = Bryan Masterson
KK7EHG = Landon Shepherd
KK7EMJ = Elijah Konchar
KK7EMK = Leslie VanFleet
KK7EML = Thomas Williams
KK7ENG = Kodey Crandall
KK7ENI = Jay Duerden
KK7ENJ = Steven Geduld
KK7ENK = Alan Hauley
KK7ENL = Laura Hauley
KK7ENQ = Dan LaPray
KK7ENR = Steven McCown
KK7ENT = Curtis Quist
KK7ENU = William Stocks
KK7ENV = Bruce Sundstrom

Upgraded hams

KF7UCX = Bob Bruckner (General)

Congratulations to all these diligent folks! We look forward to hearing you on the radio soon.

Events

Upcoming happenings

Winter Field Day 2022 report

Winter Field Day was an epic success, in that we racked up 13560 points from 1103 contacts, a whopping 42 % increase over last year's 9549 points from 850 contacts, which put UVARC in the top spot state-wide last year. More importantly, it was a success because you came and supported us and helped get us set up, and ate our pizza.

Attendance and help was up quite a bit this year, and included many new hams, but we certainly missed a lot of good people who normally show up at our events.

We're very grateful to Chad Bowcut KD7BKO, for setting up the communication trailer and the laptops, linking them to help us coordinate band usage and logging. Big thanks go out to Carl Pockrus WE7OMG, Chad Buttars WE7CB, Ralph Nunn K7RLN, Adam Hall KJ7STI, Jeremy Giovannoni K7TEH, Harry English AA1HE, Ryan Steele AF7RS, Paul Mathews W7BG, Noji Ratzlaff KNØJI, and the many others who endured the long hours of the lonely night calling CQ for us. Thanks also to Jeff McGrath N1SC for his drone video and Kevin Bowen K7SW for his instructive video of our event.

76ers Annual Barbecue

Lynn Hancock K7LSH and Carl Pockrus WE7OMG have once again secured the pavilion at Highland Glen Park for our annual barbecue, this year on Saturday June 4, from 10 am to 3 pm.

If all goes as planned, we'll have a fox hunt, an HF station set up for you to get on the air, and a door prize drawing. If you'd like to contribute toward the food or door prizes, please alert Carl or Jeremy Giovannoni K7TEH.

We hope by then we can remove our face coverings and shake each others' hands, but we'll have to play it by ear, and update you during the nets and on Facebook, as we get closer.

Summer Field Day

Is it too early to give everybody a heads up for Field Day 2022? Our location this year will be a little different from that of past years, in that, instead of parking in the usual loop we normally use up Co-Op Creek, we plan to be stationed up Chicken Creek, about 3 miles to the southeast, at an open location. More details later.

The Ugly Antenna Contest

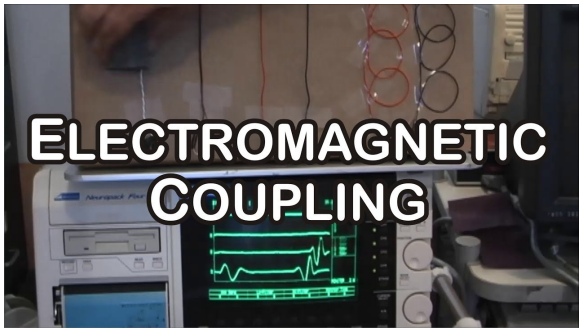
Yes, we're holding our first-ever Ugly Antenna Contest this coming July. Anybody can enter an antenna into the contest, but the owner must demonstrate that it can transmit farther than a city block on an amateur frequency. We'll have three judges who'll decide which working antenna is the ugliest. The top three will win prizes, but first place wins a used HF radio.

We're holding it in connection with the Ham Radio Fair 6:00 pm on Thursday 14 July 2022, in the Lindon Community Center, 25 N Main St. We're getting closer, so stay tuned!

Brass Tacks

An in-depth look at a radio-related topic

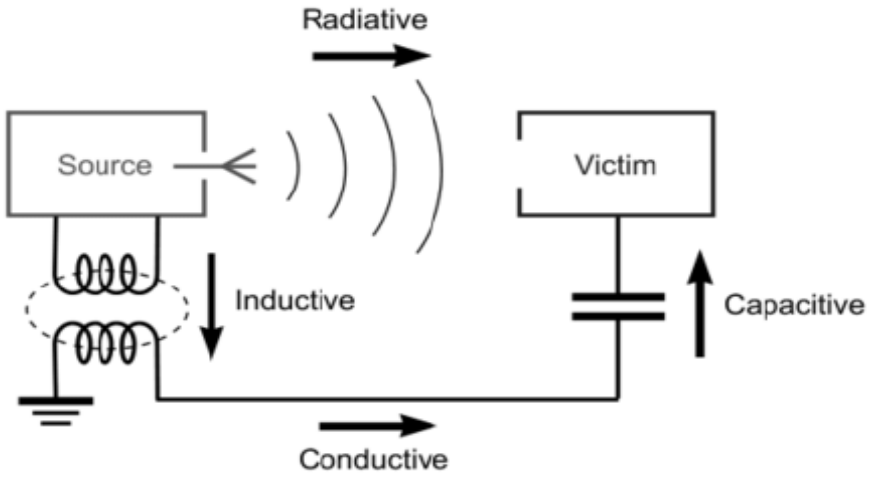
Coupling



An RF (radio frequency) signal can be present as electrical AC (alternating current) in a wire or an EM (electromagnetic) signal transmitted through space. Transferring this energy between two or more circuits can be done by wiring the circuits together, known as *conductive coupling*, or by "connecting" them wirelessly. This discussion focuses on the RF connection made through EM fields, the wireless method.

EM coupling is a phenomenon that's both indispensable to the workings of amateur radio, and at times an unintended, interfering nuisance. It's manifested in at least two different effects, known as *inductive coupling* and *capacitive coupling*, but for the purposes of amateur radio, I'll treat them the same, and simply call them both ***coupling***. To save you the headache of reading through the physics of wireless coupling, I've inserted a few paragraphs on the details near the end of this article, for those who really want to understand the fundamentals behind it.

For completeness, yet also not part of this discussion, one more type of EM coupling, *radiative coupling*, in a way connects your radio antenna with that of another radio, allowing wireless communication between stations. Furthermore, publications that address classical EM coupling often refer to a *source* circuit to identify the origin of an interfering signal, and a *victim* circuit or conductor as the recipient of the signal, to describe their interaction.



The four major types of coupling illustrated

The reason you need to know all this is because ***the objects that get coupled with your antenna become part of your antenna system***. Once you start grasping the idea of coupling, the better you can envision the effects of antenna placement, transmission line shielding, and some causes of impedance mismatch (resulting in high SWR) in your antenna system.

Brass Tacks

continued

Antenna element proximity

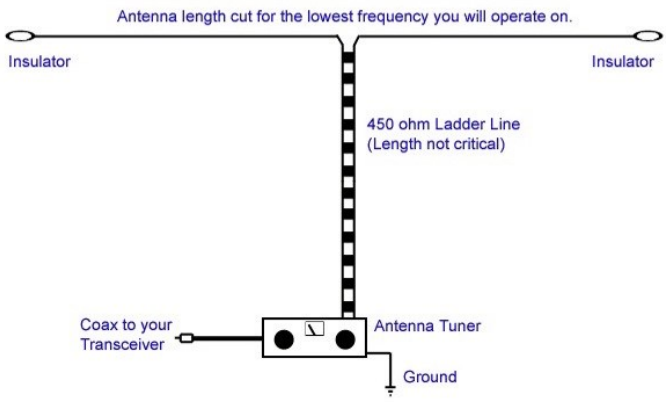
One day a local ham proudly showed me a photo of his newly installed Pockrus J-pole, but added that it didn't seem to work very well. Indeed, his antenna was more than twenty feet up in the air, but he said people on line-of-sight repeaters had complained about his signal. Glancing at the photo, it was fairly obvious what was going on. He had bolted the metal angle bracket to the aluminum siding of his house, which placed the three vertical elements less than an inch from the siding.

I told him that he had effectively coupled his antenna with his house, making the aluminum exterior an extension of his antenna, essentially turning his house into a huge, non-resonant antenna at VHF frequencies. He noted that he had gone through great pains to mount it where it was, and asked whether I was certain that the antenna's proximity to his siding was the reason for the bad signal reports. I told him that, if everything else was working as they should be, I believed that to be the case.

After a few more trips up his ladder, my friend installed a mast on the side of the house, and mounted his J-pole to the mast, clear of any metal, and said that people now gave him great reports, even on simplex much farther away. So, the two lessons learned here were that a) it's good to know which part of an antenna is responsible for radiating a signal, and b) to make sure and keep that part of the antenna away from anything conductive.

Ladder line proximity

Coax (coaxial cable) is a wonderful invention, in that its proximity to surrounding metal objects will not affect its characteristics much. I say "much" because there are a few exceptions, such as its use in an RF choke.



Doublet antenna, which uses a matching ladder

On the other hand, ladder line (including window line, ribbon-line, and open-wire line) is very susceptible to behavior change due to coupling with nearby conductors. Take precautions to keep ladder line, whether it's used as a feedline or a matching section, away from anything metal.

More than once, I've visited the home of a G5RV or Zepp or doublet owner who has complained about his signal or SWR, only to see the ladder section partially lying on the ground or draped against aluminum siding.

Brass Tacks

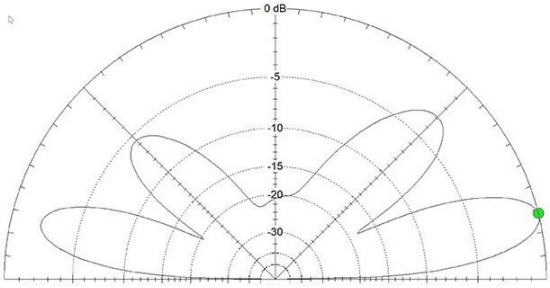
continued

How close is *close*

Ok, so now you know that you should not mount your antenna close to anything conductive unless your design calls for it. But just how close is *close*? There's no easy answer, because the proximity is frequency-dependent and pattern-dependent. To arrive at a concrete answer, I've had to ask myself how close I want the antenna to a metal object if I *wanted* them to couple, and then try to remain clear of that distance.

Quite a lot of research (electronic simulations, calculations, plus real-life measurements) has gone into locating that perfect separation between the driven element and reflector of a Yagi antenna, for example, and many findings agree that a quarter-wavelength seems to be nearly ideal. Using this "quarter-wavelength" spacing is far from a perfect ruler, but does offer some guidance that can be used somewhat generally.

Radiation patterns



If you're aware of your antenna's radiation pattern, it's possible to mount your antenna, such that nearby conductive materials fall outside the *effective space*, or the lobes of the antenna pattern, and in the *nulls* instead. The term "effective space" is something I made up, but I'm using it to mean that space in which the coupling effects are *noticeable*, due to the relative proximity of the conducting materials in or near one of the lobes, as displayed by the antenna pattern. (My "effective space" term is not to be confused with *effective area* or *aperture*, a receiving antenna concept.) For example, in the above sample pattern, if I had to mount my antenna near a metal light fixture, I might want to install it so that the fixture is about 30˚ up from the antenna, to minimize the coupling effects with that light fixture.

A Yagi antenna works on the principle that its parasitic elements lie within the effective space of the driven element. The driven element of a Yagi antenna is *intended* to couple with its reflector, which actually extends the effective space around the antenna to include that longer element, elongating the main lobe, increasing the antenna's gain.

Conductive materials

Vegetation (trees, shrubs, tall grass) can also be subject to coupling, but it's more of a radiative obstruction than a coupling concern, and can often be dismissed. Even nearby or attached trees possess little ability to couple with an antenna, HF or VHF. A ground-mounted vertical antenna will much more readily couple with a metal shed a few feet away than with a tree a few inches away.

Weather can turn some non-conductive things (tree limbs, vinyl fences, wooden sheds) into conductive ones, which can be subject to some amount of minor coupling. Also, moisture (rain, snow, dew) from the weather can coat your coax, PVC pipes, and other nearby objects that are normally non-conductive. But their coupling capability also remains low.

Metal siding, stucco, the dirt, a swing set, rain gutters and downspouts, ductwork, metal soffits, house wiring, and copper pipes, on the other hand, can all conduct electricity to one extent or another, and can therefore couple with an antenna element if it's installed nearby.

Brass Tacks

continued

Taking an example from the Yagi antenna once again, conductive materials can use radiative coupling to capture a portion of the wireless signal, and re-radiate it. If the re-radiated signal is close enough to your antenna (the source), it can alter your transmitted signal through destructive interference. If the re-radiated signal is not close enough to your transmitting antenna to affect the transmitted signal, it can still affect what is received from you by others, due to multi-path.

How you can know

Now that you know what can cause coupling, and why it might not be a good thing, how would you know that your antenna is coupling with something, and what can you do about it? My antenna analyzer, a RigExpert AA-170, can display real-time SWR at a selected frequency as I move my antenna around, allowing me to "see" the coupling effects nearby objects have on my antenna. And when I do find an exception to some of the unlikely coupling situations I mentioned, I can often use a tuner to compensate for the mismatch or coupling, especially on HF.

If you really want to know

DC current flowing in a wire will result in a steady magnetic field around the wire (Biot-Savart Law). If the wire carrying the DC current is then brought close to a second wire, one that's not carrying a current, the first wire won't have much of an effect on the second wire. AC current (one that changes polarity every fraction of a second) flowing in the first wire will result in a *changing* magnetic field around the first wire (Ampere's Law). If the wire carrying the AC current is then brought close to the second wire, the same one that's not carrying any current, the second wire will now have an AC voltage induced across it (Faraday's Law).

So, we can gather a couple of conclusions from this. First, even though the two wires are not electrically connected to each other, the second wire ended up with a voltage across it. Second, this coupling action could only occur by AC, not DC, electricity. These two conclusions form the basis of how inductive coupling works, and forms the foundation of electric motors, generators, transformers, and other devices that use tightly wound coils to achieve their purposes.

A capacitor is a (typically) two-conductor component that prevents the flow of DC current between a circuit connected to one capacitor lead and a second circuit connected to the other. However, AC current can *seem* to flow through a capacitor connected between the two circuits, depending on the frequency. In a capacitor, the energy is transferred by means of its electric field, which can be modified (enhanced or degraded) by the physical material (dielectric) between its two conductors.

Summary

Wireless coupling is the connection between two wires or circuits by radio waves or changing magnetic or electric fields. For amateur radio, it's both necessary and can be a problem. When the effects are desirable, you can take steps to enhance the coupling, and help your antenna work better. When the effects are unwanted, you can take steps to eliminate or at least minimize the coupling, and improve your station's performance.

Noji Ratzlaff, KNØJI (kn0ji@arrl.net)

Dear Annette

What's on your mind? Serious, humorous, technical, and thoughtful answers to your deepest, (mostly) ham-related questions.

Dear Annette:

I recently learned that the bandwidth of an antenna is measured by wherever in the band the SWR is 2:1 or less. Why 2:1? Seems kind of arbitrary.

Floyd in Springville

Dear Floyd:

You're correct, that the bandwidth of an antenna, for a particular band, is determined by where its SWR is 2.0:1 or less within that band. The bandwidth of a bandpass filter, for example, can be determined by the frequencies at which its output (P_O) presents a signal that is -3 dB the strength of its input (P_I) signal. This is because

$-3\ dB = 10\log_{10}(P_O/P_I)$ and so

$-3/10 = \log_{10}(P_O/P_I)$; therefore,

the ratio $P_O/P_I = 10^{-3/10} \approx ½$.

As a result, this is also known as the *half-power bandwidth*. By a similar concept, if the load impedance (Z_L) is half the characteristic impedance (Z_0), then

$SWR = Z_0/Z_L = 50\ \Omega/25\ \Omega = 2.0{:}1.$

And if the characteristic impedance is half the load impedance, then

$SWR = Z_L/Z_0 = 100\ \Omega/50\ \Omega = 2.0{:}1.$

So, it's the bandwidth of frequencies for which the load impedance is half the characteristic impedance and greater, up to the characteristic impedance, or for which the characteristic impedance is half the load impedance and greater, up to the load impedance.

Dear Annette:

Is there a backstory to the critter (aardvark?) on the front page of the newsletter?

Bob in Morgantown (WV)

Dear Bob:

Yes, our mascot is an aardvark, due to our club name – UVARC, because it sounds like saying *you 'vark!* which sounds short for *you aardvark!*. So, our mascot's name is *U – vark*.

Dear Annette:

As I understand it, the ionosphere is made of layers called the D layer, the E layer, and the F layer. Are there also A, B, and C layers too?

Todd in Eagle Mountain

Dear Todd:

In 1924, Edward Appleton explored the reflection of radio waves off the ionosphere, and coined the term ***E layer*** because it seemed to reflect the ***e****lectric field* of radio waves. He then discovered a higher ionospheric layer of even greater ionic density, and called it the ***F layer*** because of its high *re****f****lectivity*. Appleton later identified a lower layer that's responsible for ***d****aytime* radio wave absorption, and called it the ***D layer***. As far as I know, there's no A, B, or C layer.

Dear Annette:

As I understand it, RF is something that travels through the air. So, how is it that we call a high-frequency electrical shock an RF burn? (See exam question TØCØ7)

Mike in Highland

Dear Mike:

RF refers to radio frequency signals of all types (exam question T5CØ6), whether they're electrical (by wire) or electromagnetic (through air and space).

Got a question for Dear Annette*? Email it to* ***uvarcshack@gmail.com*** *and include your town name. Sorry, no guarantees.*

The Amateur in You, Part 1

What have you been pondering?

Frequencies and bands

Those of us who live in the US feel right at home when we hear feet, miles, and pounds, but mention meters, liters, and kilograms, and many of us find we're suddenly outside our comfort zone. The world of amateur radio can catch Americans off-guard because many amateur measurements are based on the metric system. Typically, the trouble starts with frequency, wavelength, and bands.

Frequency

Frequency is number of times something happens a second, or a minute, or an hour. For example, you know it irritates people to hear you say "uh" while you're giving a speech. So, you ask a friend to listen and count for the number of times you say "uh" during a trial run. Your friend reports, "fourteen times a minute." That's your "uh" frequency.

Your radio sends electricity up and down your antenna, and as it does, the electricity disturbs the space around the antenna by generating a certain radiation, known as ***radio waves***, outside the antenna. The rate at which these radio waves pulsate is known as its ***frequency***, measured in ***hertz*** (meaning "times a second"), and is the same rate as the up-and-down travel of the electricity.

Wavelength

When you toss a pebble into a still pond, ripples (small waves) start forming around the spot where your object entered and disturbed the water, and move outward, away from the spot. The ripples appear very regular, at a fairly constant width between each of them. This width is called ***wavelength***, because it's the length of space between the tops of each wave. Radio waves are invisible, but act much the same way, only without water.

It just so happens that frequency and wavelength are related to each other. That is, if the up-and-down wave motions occur more often, then more of the waves travel out from the point of disturbance for the same amount of time, and therefore the width between each wave becomes shorter. In radio, the waves always travel the ***speed of light***, but the width between the waves depend on that up-and-down frequency of the electricity. In fact, we find that ***the wave frequency times the wave length is equal to the speed of light***, which is 300 million meters a second.

Radio waves occur at a variety of frequencies, measured in millions of hertz, or megahertz (MHz, or million times a second). So, a radio signal of 150 megahertz has a wavelength of 300 million meters ÷ 150 million hertz = 2 meters. We can simplify this, because both of the "millions" cancel. So 300 meters ÷ 150 = 2 meters, the width between waves.

Band

Many radio waves with frequencies that are somewhat close to each other, like the range, or ***band***, of frequencies between 144 MHz and 148 MHz, behave alike, yet the radio waves with frequencies in that range behave somewhat differently from those between, say, 7.0 MHz and 7.3 MHz. But if we want to distinguish the two ranges, saying "144 MHz through 148 MHz range" or "7.0 MHz through 7.3 MHz range" gets old pretty quickly.

It turns out that the 144 MHz through 148 MHz range of frequencies has a wavelength of 300 ÷ 144 ≈ (equals about) 2 meters, and the 7.0 MHz through 7.3 MHz range of frequencies has a wavelength of 300 ÷ 7.0 ≈ 40 meters. So today, it's more convenient to refer to them by their band names, which are named for their approximate wavelengths, as in the "2-meter band" and "40-meter band" instead. And that's where we get the names of our amateur radio bands.

The Amateur in You, Part 2

What have you been pondering?

Decibels

The term *decibel* often shows up in literature, specifications, and exams. Many believe it's a standard of audio loudness, while others in the technical world find it to be a somewhat cryptic way of measuring things. Turns out it's a method of describing a ratio between two values, making it a unitless descriptor.

History

In the early days of telephone, it was well-known that the longer the wire, the more the phone signal degraded. So, engineers came up with a way to measure the loss by MSC, or *miles of standard cable* for wire close to today's 19 gauge. In 1924, Bell Telephone came up with the TU, or *transmission unit*, which is a logarithm-based value that allowed for easy calculations of both small and large numbers. In 1928, ten TUs was declared to be equal to a *bel*, in honor of Alexander Graham Bell.

The bel began to replace the TU, but it soon became more popular to refer to *tenths of a bel* instead of bels for two reasons. One is that a tenth of a bel is the smallest difference in loudness discernible to the human ear, as had been determined in that day. Another is the convenience of calculation, as will be shown here. This tenths of bels, therefore, came to be called ***decibels*** (abbreviated "dB"), and is defined as

$$1\ dB = 10\log_{10}(S_o/S_i),$$

or ten times the based-ten logarithm of the measured (output) signal divided by the reference (input) signal.

Keep it simple

We can simplify most dB calculations and conversions by using the following:

3 dB = **two times** −3 dB = **half**

10 dB = **ten times** −10 dB = **tenth**

This means, if a signal changes by 3 dB, its strength doubles; if it changes by 10 dB, it's ten times as strong. But remember that decibels are based on logarithms, and one reason that decibels make calculations easier is that when values multiply, logarithms add, and when values divide, logarithms subtract.

This way, if a signal changes by 9 dB, its strength increases by 3 dB + 3 dB + 3 dB = 2 x 2 x 2 = 8 times. And if a signal changes by 23 dB, its strength increases by 10 dB + 10 dB + 3 dB = 10 x 10 x 3 = 300 times! By the same idea, if a signal changes by −12 dB, its strength becomes −3 dB −3 dB −3 dB −3 dB = ½ x ½ x ½ x ½ = 1/16 as much.

Application

As much as we tend to use decibels for radio and electricity, it can be used for nearly any ratio. If I have five marbles on one day, and twenty marbles the next day, my quantity of marbles increased by 20 ÷ 5 = 4 times, which equals 2 x 2, or 3 dB + 3 dB = 6 dB.

For added convenience, we sometimes append a modifier to the dB, such as dBi (referenced to an isotropic radiator), dBd (referenced to a dipole), and dBm (referenced to a milliwatt).

Finally

More typically, the unitless decibel is used to denote a ratio in antenna gain or signal strength in our amateur radio world. On HF, for example, according to Part 97.307(d), the largest spurious emission legally permitted is −43 dB of the primary or fundamental signal, or −10 dB −10 dB −10 dB −10 dB −3 dB = 1/10 x 1/10 x 1/10 x 1/10 x 1/2 = 1/20,000 of the primary signal. This means if I've set my HF power to 100 watts, then the largest allowable spurious signal is 100 watts x 1/20,000 = 1/200 of a watt, or 5 mW!

Hot Tips

Good info for the new ham, and old stuff to refresh your memory

Announcing your call sign

In light of a long history of old traditions and habits, it's no surprise that many hams, especially newer ones, are a little confused about when it's appropriate to announce their call signs on the radio. It seems most of us are aware of the basic rules of saying it ***at the end of the communication*** and ***every ten minutes***, but are there other times when it's a good idea, or even necessary? For clarity, your ***assigned call sign*** is the one that FCC has assigned you, if you're an American. A ***vanity call sign*** is also an assigned call sign, because it replaces your former assigned call sign. Here are some tips for American amateurs:

- It's a courtesy to announce your call sign at the start of your conversation, but not necessary
- It's a courtesy to announce other people's call signs, but again, not necessary, not even when calling for them
- If you do use both your call sign and the other person's call sign, the convention (not a rule) is to ***say your own last***
- It's not necessary to wait until the repeater has completed announcing its ID, to announce your call sign (they're typically designed so that your transmission will override its ID announcement)
- It's not necessary to say "for ID" when announcing your call sign, since that's understood
- You must announce your call sign in English
- A *partial call sign* is not a call sign at all, but is a ***tactical call sign***, which in fact does not need to resemble your assigned call sign, and so does not replace your assigned call sign
- When using phonetics to announce your call sign, using one or more letters from an alternate phonetic alphabet is perfectly acceptable, as long as you remember to slow down
- On a repeater, it's not necessary to announce your call sign using phonetics, unless you're not being heard well, or the net control operator asks you to do so
- Announcing your call sign with every transmission is unnecessary, and will likely only irritate others
- When you're operating in behalf of another station (during Field Day, special event, contest), be sure to announce your own assigned call sign ***once every hour***
- When you announce your call sign at the end of your communication, it does not need to be the very last thing you say
- When you announce your call sign at the end of your communication, you don't even need to say it in your final transmission

This short checklist is by no means comprehensive, but it's a start into helping us decipher between rule and tradition. Are there other call sign tips you can think of?

Noji Ratzlaff, KNØJI (kn0ji@arrl.net)

DIY

Worthwhile projects you can build on your own

6-band Windom antenna

Every so often, I get a request for an all-band HF antenna, and I'm not sure I know of such a design, except maybe a random wire with a super-duper tuner. Really good tuners are worth their weight in gold, but unfortunately most of them cost like they're made of it too. The object is to require only the tuner (3:1 SWR at best) internal to your radio, if yours has one.

It just so happens there's a good antenna that works well on six bands, and might fit the need for the most useful HF bands. In this case, **80-meters**, **40-meters**, **20-meters**, **15-meters**, **12-meters**, and **10-meters**. It's known as a ***Windom*** antenna, which is an OCF (off-center-fed) dipole with a twist. We discussed an OCF dipole in the June 2019 issue of the *UVARC Shack*, but it covered only four bands. The typical impedance of a Windom antenna (≈200 ohms) requires the installation of a 4:1 current balun, covered in the January 2020 issue of the *UVARC Shack*.

The Windom antenna differs from other OCF antennas because of a *center load*, which is designed to compensate for the impedance exhibited on 80 meters, and made from a capacitor and a snubber resistor. Because OCF antennas are notorious for conducting common-mode current, a *sheath current choke* is also added. Design credited to Serge Stroobandt ON4AA.

Parts list

140 feet of 14 AWG stranded wire

Two toroidal FT240-31 ferrite cores

One 470 pF 15 kV doorknob capacitor

Ten 1730 snap-on 7 mm ferrite cores

One 1-½″ x 3/16″ eye bolt

One 4.7″ x 3.2″ x 2.6″ enclosure

One 1-3/8″ x 2-7/8″ fiberglass screen

Two #8 screws, wing nuts, washers, split washers

Hot glue and gun

One SO-239 bulkhead connector

80 inches of 18 AWG zip wire

One 1 M-ohm 1W resistor

14 inches 1″ heat shrink tubing

Eight 14 AWG #8 stud ring terminals

One 14 AWG #4 stud ring terminal

Crimp sleeves (optional)

4 each M3 screws, split washers, nuts

Super Glue™

Three dogbone insulators (you can fabricate these from ½″ PVC, about 3″ long each)

Pair of FT240-31 toroids

Dogbone insulator

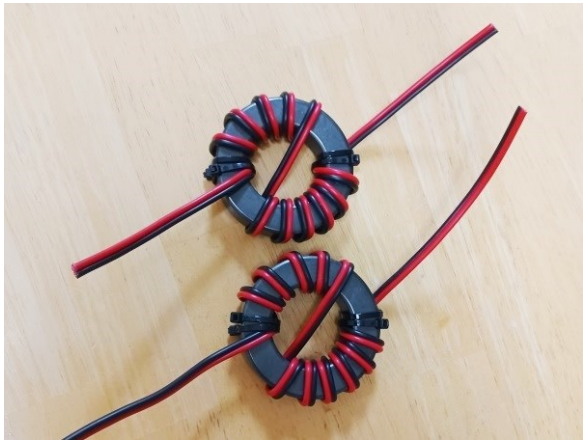
Doorknob capacitor

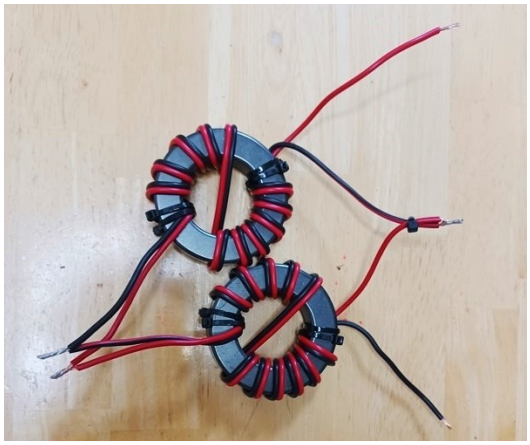
DIY, continued

6-band Windom antenna

Construction

Let's start with the most difficult part, the *Guanella* 4:1 current balun, which begins with the toroids. No need to apply tape or any other covering over the toroids. Wind the two toroids identically, but with the red wire on the left for one, and the red wire on the right for the other, as in the photo. For each toroid, ***tightly*** wrap six turns of the wire pair on one side, then cross the pair over then under the diameter to wrap six more turns in the same direction, but on the other side of the pair. Zip-tie the two ends to secure them in place, leaving about four inches of wire pair on each end to work with, then strip all eight wire ends. (For reference, the ***transceiver end*** is on the left side in this photo, and the ***antenna end*** is on the right.)

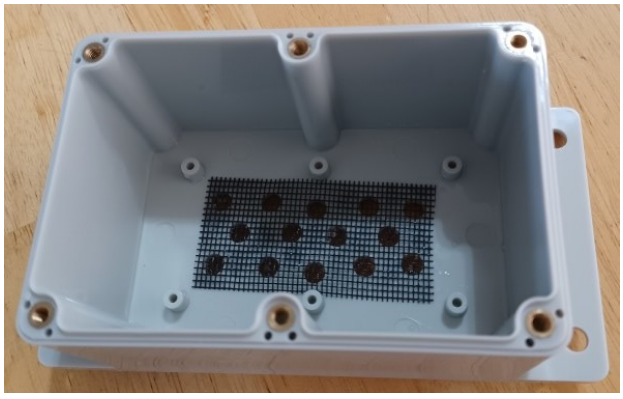




At the transceiver end, twist the two red wires together, and the two black wires together. At the antenna end, twist the black wire of one toroid with the red of the other toroid, solder them together, and cover the junction with small heat shrink tubing, if you want.

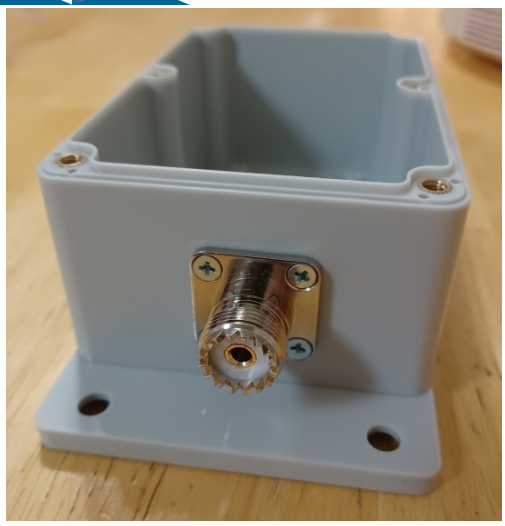
Assemble the balun enclosure

Drill twelve to sixteen ¼″ holes in the back of the enclosure, for ventilation. Cover the holes by super-gluing the fiberglass screen over them on the inside, to prevent insects and debris from entering the enclosure.



DIY, continued

6-band Windom antenna



Drill a ½″ hole in the enclosure at one end I'll call the ***balun bottom***. Place the solder end of the SO-239 bulkhead into the ½″ hole on the outside of the enclosure, and using the four mounting holes of the bulkhead as a template, drill a 1/8″ hole for each mounting hole.

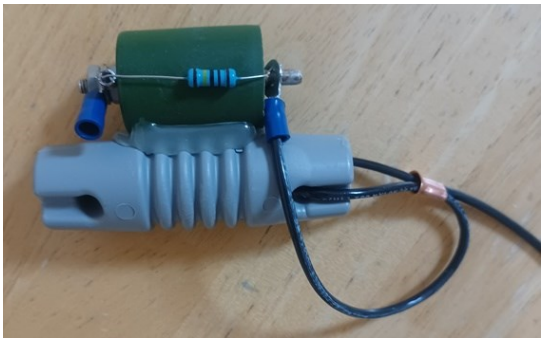
Drill a 3/16″ hole in the ***balun top***, about 1-¼″ from the rear of the enclosure. Install a nut and then a flat washer onto a 3/16″ eyebolt, and slip the eyebolt assembly through the hole. Secure the eyebolt with a split washer and another nut. This eyebolt can be used to hang the balun and relieve some of the strain on the wire elements due to the weight of the balun, the sheath current choke, and the coax.

Zip-tie the two wired toroids together, one on top of the other. At the transceiver end of the wired toroids, solder the red pair to the center cup of the bulkhead. Solder the black pair to the #4 x 18 AWG ring terminal. Solder the red wire of the antenna end to a #8 x 18 AWG ring terminal, and the black wire to another. Assemble the bulkhead onto the enclosure using the M3-0.5 mm hardware, with the #4 ring terminal bolted to one of the screws.

Drill two 3/16″ holes on opposite sides of the enclosure near the balun top (the end opposite that of the bulkhead connector). For each side, install a #8 machine screw through a #8 ring terminal attached to one of the toroids, then through the 3/16″ hole from the inside. Install the washer and wing nut on the machine screw on the outside of the enclosure. Install the enclosure cover, and the balun construction is complete.

The center load

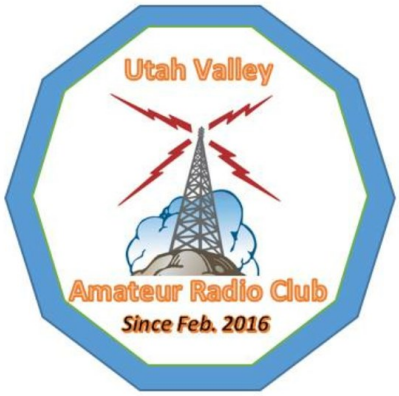
Bend the leads of the snubber resistor around the doorknob capacitor, and solder them to a pair of #8 ring terminals. Bolt another #8 ring terminal to each capacitor terminal for the elements. Hot-glue the doorknob capacitor onto an unused dogbone insulator, and the center load construction is complete.



Most wire-type antennas made for 80 meters typically exhibit a relatively low bandwidth. The purpose of the center load is to broaden the bandwidth of the 80-meter antenna without sacrificing the other bands. It's placed in the very middle of the (entire) antenna because that's the location of lowest current for all signals of even harmonics. The end result is that it gives us a lot of room to play with.

DIY, continued

6-band Windom antenna



Assembling the elements

Cut a 30-foot section of the 14 AWG wire. Slip one end through a crimp sleeve, through the left hole in the enclosure, then back through the same crimp sleeve. Install a #8 ring terminal on the wire after pulling it through the crimp sleeve. Secure the ring terminal to the left exposed terminal of the balun with a wing nut. Slip the other end through an unused dogbone insulator and tie it off at ***26 feet 4 inches***.

Cut a 42-foot section of the wire. Slip one end through a crimp sleeve, through the right hole in the enclosure, then back through the crimp sleeve. Install a #8 ring terminal on the wire after pulling it through the crimp sleeve. Secure this ring terminal to the right exposed terminal of the balun with a wing nut. Slip the other end of the 42-foot wire through another crimp sleeve, through a hole of the dogbone insulator of the center load, then back through the crimp sleeve, making this the left side of the center load.

Install a #8 ring terminal on the wire after pulling it through the crimp sleeve, such that the length of the wire between the crimp sleeve at the right side of the balun and the crimp sleeve on the left side of the center load is ***40 feet 9 inches***. Pull a 70-foot wire through a crimp sleeve, through the right side of the center load, and back through the crimp sleeve, then install a #8 ring terminal on it and bolt the terminal to the right side of the center load. Slip the other end through an unused dogbone insulator and temporarily tie it off at ***67 feet 7 inches***.

The sheath current choke

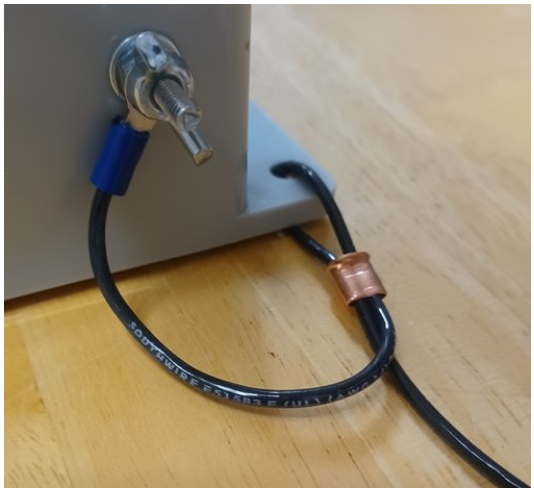
Straighten a two-foot end of a 50-foot-long RG-8X coaxial cable that has been terminated on both ends with PL-259 connectors. Snap ten ferrite beads onto the coax jacket, as close to each other as possible. Slip the heat shrink tubing over all ten beads and heat-shrink the tube. You'll want to dedicate this coax to this antenna project, or any other that requires a sheath current choke.

The most common source of RFI (radio frequency interference) that occurs with OCF dipole antennas is the induced RF current that flows back into your transceiver on the outer skin of the coax braid. In general, OCF antennas are prone to this effect because the coax is positioned asymmetrically with respect to the antenna elements.

While the Guanella current balun is designed to choke much of the common-mode current that causes RFI, its function is primarily for the impedance transformation process, so its effectiveness against the high-powered unbalanced current generated by an OCF dipole remains lacking, requiring this current choke.

DIY, continued

6-band Windom antenna

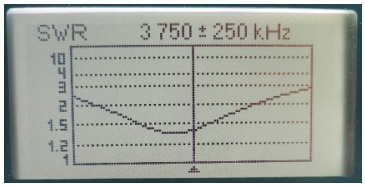


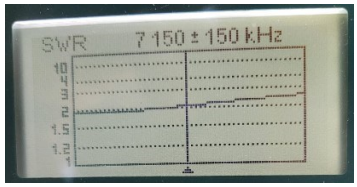
Crimp sleeve and ring terminal

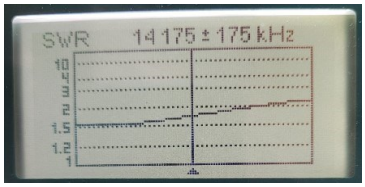
The finished antenna and sheath current choke

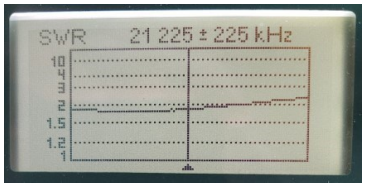
Test time

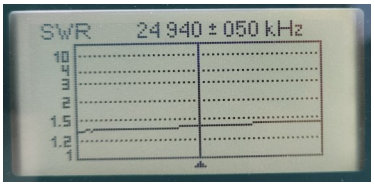
When it was time to check out the antenna, Kent Flowers N7EKF volunteered his help, which reduced the mount and test time considerably. This antenna is made to hang about 55 feet up, but we had the luxury of mounting it only 24 feet high. It turned out that all six bands were well within tuning range of an HF rig with an internal tuner, which can typically handle an SWR of 3.0:1 or lower.

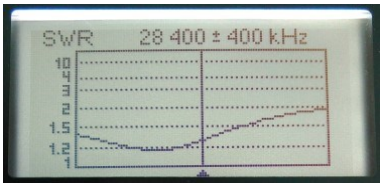












Summary

Our Windom antenna supports six HF bands, the ones you're most likely to use. This particular design for the Windom antenna includes a balun, a center load, and a sheath current choke. The construction is somewhat straightforward for the most part, but can get involved in the transformer balun. This design is optimal if the antenna is mounted about 55 feet over the dirt, for average soil conductivity.

Noji Ratzlaff, KNØJI (kn0ji@arrl.net)

Living in the Past

Historical perspective

The forgotten genius

In 1897, at age 31, Reginald Fessenden, in a conversation with his uncle, coined the term CW, or *continuous wave*. He and others reasoned that such a wave could be used to communicate a message much more effectively and efficiently than by the conventional spark gap transmitter that ruled the air at the time. Using this idea of a continuous wave, Fessenden made the first AM (***amplitude modulation***) transmission of speech on 23 December 1900. It wasn't until Edwin Armstrong developed the vacuum-tube oscillator in 1912, that Fessenden was able to use an inexpensive means of creating a carrier wave to produce practical AM signals, paving the way in broadcast and amateur radio for decades to come.

One problem that plagued Fessenden's transmitter-receiver was its inability to selectively receive and detect a weak signal. He solved this by combining the received signal with another of a known frequency, and extracted the difference. He called the method ***heterodyning***, which today remains the standard receiving analog circuit. In 1906, experimenting with high-frequency (100 kHz) alternators, *Fessenden made the first two-way transatlantic radio transmission*. (The previous "first transmissions" by Marconi, Tesla, and Loomis were all one-way.)

Other inventions to his credit

Motivated by the 1912 *Titanic* disaster, Fessenden developed SONAR (sound navigation and ranging) on 27 April 1914. Previous to that time, mariners would locate icebergs and other dangers by ringing bells, or detect the depths of the sea floor by dropping long, weighted ropes. With the Fessenden oscillator, one can do both of these by electrically sending out a ping, and then electrically detecting its return. His development has been credited with the saving of countless lives above and below the ocean waves.

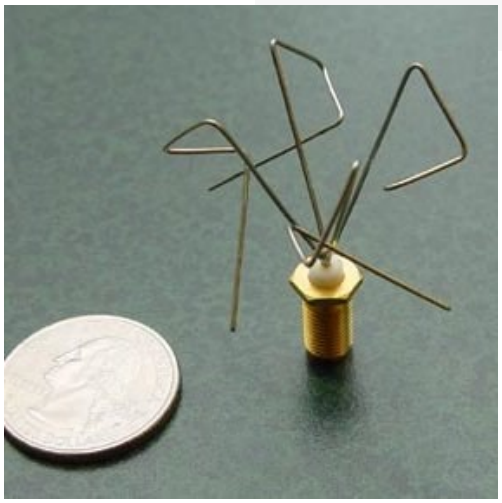
He invented silicon steel, which replaced the lossy carbon steel in transformers and motors. He invented microphotography, an early form of microfilm. He invented the pager, the turbo-electric drive for ships, the gyrocompass, the loop antenna, RDF (radio direction-finding, or as we sometimes call it, *fox hunting*), ultrasonic cleaning, electrical conduit, and tracer bullets. He discovered that atoms had a positive center and negatively charged surface. In spite of all of Thomas Edison's advancements, it was Fessenden who transformed the incandescent bulb from a novelty to an everyday necessity. In total, Fessenden held around 230 patents. Yet, today's texts barely mention his name, being overshadowed by larger, more popular notables.

Side of Bacon

A little ham humor

Inspiration for the Ugly Antenna Contest

Judging by the imagination shown by many of our members, we really doubt they need much help, but just in case, here are some photos that might help get your creative juices flowing.



For Your Insight

Information you could use

Club meeting format

Here's the usual agenda for club meetings, at the Orem City Council Chamber Room, 56 N State St:

Talk-in frequency on the club repeaters

6:30 pm : Eyeball QSO

socialize / put faces with call signs

radio programmers available to help you

6:45 pm : Call the meeting to order

meeting lineup (agenda)

announcements / nets / awards / calendar

7:00 pm : Discussion / breakout session

discussions typically involve everybody

breakouts split into separate groups

7:45 pm : Door prizes

7:55 pm : Dismiss and disassemble

8:00 pm : *Club QSY* to a local eatery

Something you'd like to see at the meetings?

Monthly meeting help

We're grateful for the volunteers who help with various tasks that make our club night just that much more friendly and useful to everybody. Monthly, we need help with

programming radios (thanks, Loren / Ralph / Mickey!)

taking photos or videos during the meeting

operating the talk-in radio

setting up tables and chairs (thanks, Heath!)

Lynx

Websites for your education and leisure

Ham radio equipment

Ham Radio Nets

Radio programming

76ers Group and UVARC Group pages

Utah Ham Radio Exam Schedule

Send your input to ***uvarcshack@gmail.com***

Test your knowledge

General and Extra review (answers next page)

G9DØ2 : What is the feed-point impedance of an end-fed half-wave antenna?

A. Very low
B. Approximately 50 ohms
C. Approximately 300 ohms
D. Very high

E9FØ1 : What is the velocity factor of a transmission line?

A. The ratio of the characteristic impedance of the line to the terminating impedance
B. The index of shielding for coaxial cable
C. The velocity of the wave in the transmission line multiplied by the velocity of light in a vacuum
D. The velocity of the wave in the transmission line divided by the velocity of light in a vacuum

Calendar

What's happening
(times are Mountain Time)

Utah County Ham Exam Sessions

BYU J. Reuben Clark Law School building

Sign up at HamStudy.org/sessions

Sat Apr 17, 2:30 to 5:00 pm
Wed Apr 20, 7:00 to 8:30 pm
Wed May 18, 7:00 to 8:30 pm
Wed Jun 15, 7:00 to 8:30 pm
Sat Jun 18, 2:30 to 5:00 pm
Wed Jul 20, 7:00 to 8:30 pm

Provo One-day Technician Courses*

Third Saturday Monthly at 8:00 am
BYU Law School Bldg, First Floor
** September through April*

2022 Orem Ham Radio Courses

Sign up at psclass.orem.org

Technician : Canceled
Extra : Tue Jul 12, 19, 26, Aug 2, 9
Technician : Tue Sep 20, 27, Oct 4, 11

Club Meeting Calendar (6:30 pm)

On YouTube Live, and Facebook Live

April 7	May 5
June 2	July 14[@]
August 4	September 1
October 6	November 3*

[@] Ham Radio Fair, Lindon Community Center

** DIY Night at the Orem Friendship Center*

Regular Nets

UVARC Ladies' Net, Tue 7 pm, 146.780
DMR Utah Net, Wed 6 pm, TG 3149, CC 1
Utah 76'ers, Wed 7 pm, 146.760
UVARC HF Net, Wed 9 pm, 28.345 / 7.220
UVARC New Ham Net, Thu 7 pm, 146.780
CERT Ham Net, 2nd, 4th Thu 8:pm, 146.780
UVARC 2-meter SSB Net, Thu 9 pm, 144.234
Utah County 6-meter Net, Fri 8 pm, 50.140
Family History Net, Sat 8 pm, 146.780
UVARC Family Net, Sun 3:30 pm, 146.780
See a larger list of nets at noji.com/nets

Upcoming Contests

State QSO Parties
Sat Apr 2 : MO, FL, MS, LA

State QSO Parties
Sat Apr 9 : NE, NM, TX, GA

State QSO Parties
Sat Apr 16 : MI, ON, QC

7QP (7th Call Area QSO Party)
7 am Sat May 07 to 1 am Sun May 08

See a larger list at contestcalendar.com

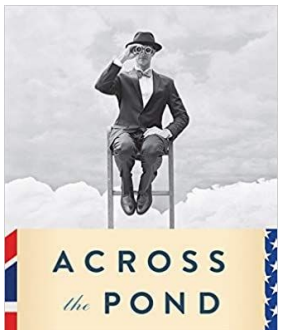
Answers to *Test your knowledge*

G9DØ2 : **D** (Very high) [see a previous article on the same, third paragraph]

E9FØ1 : **D** (The velocity of the wave in the transmission line divided by the velocity of light in a vacuum)

Across the Pond

That is, the Utah Lake 'pond'



Eagle Mountain ham radio activities

This is a list of amateur radio activities that are organized near Eagle Mountain, primarily by Dave Becar KI6OSS. Unless otherwise noted, all these activities will be held at the Eagle Mountain City Hall, 1650 Stagecoach Run. Please contact Dave at **dbecar@charter.net** to register for any of the classes or exams, for any additional information, or with questions in general.

Ham Radio Exam Session

Sat 09 April, 10 am

Open to all, for any license class

Hands-on Class

Thu 05 May, 7 to 8 pm

June 2022 General Course

Thu 26 May, 7 to 9 pm
Thu 02 June, 7 to 9 pm
Wed 15 June, 7 to 9 pm
Thu 23 June, 7 to 9 pm
Thu 30 June, 7 to 9 pm

Ham Radio Exam Session

Sat 02 July, 10 am

Open to all, for any license class

September 2022 Technician Course

Thu 01 September, 7 to 9 pm
Wed 14 September, 7 to 9 pm
Thu 22 September, 7 to 9 pm
Thu 29 September, 7 to 9 pm
Thu 06 October, 7 to 9 pm

Hands-on Class

Thu 03 November, 7 to 8 pm

Ham Radio Nets

Eagle Mountain ECT Net

Sundays, 9 pm 145.230- MHz (131.8 Hz)

Eagle Mountain Chimney Rock Stake

Sundays 8:30 pm 446.500 (s)

Eagle Mountain Central Stake

Saturday 8 pm 145.650 (s)

Vendors

For your convenience

Pockrus Joystick J-pole

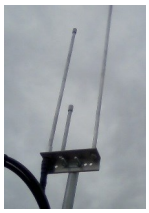
$30, open-stub aluminum half-wave, dual-band J-pole antenna

$40, 6-meter dipole, $20 for the 220 MHz (1.25 m) antenna

by Carl Pockrus, WE7OMG (email omgantennas@gmail.com to order)

Half-wave performance, solid construction, weather-proof, low wind-load

Probably the best-performing outdoor antenna you can get for the price



Super-Elastic Signal Stick

$20, vertical quarter-wave flexible antenna

by Richard Bateman, KD7BBC, of *SignalStuff* (and maker of *HamStudy*)

Super-performing antenna for your HT (handhold transceiver)

Visit SignalStuff and select SMA-Male, SMA-Female, or BNC

Ham Radio Podcasts v1.50

by Trevor Holyoak, AG7GX (email android@holyoak.com)

Stream podcasts (such as *100 Watts and a Wire*, *Amateur Radio Newsline*, *ARRL Audio News*, etc.) or download for later listening

For Android 4.1 and up (ad-free available for purchase)

Club Logo and Call Sign Embroidering

Want your call sign or name (or both!) embroidered on your shirt, your hoodie, your duffle? Or how about a club patch with your call sign?

by Glenna Gardner, WE7SEW (glenna0354@gmail.com or text 801-592-2503)

Call sign or name = $5, Both = $8, UVARC patch = $5, Patch with call = $9

Portable Aluminum J-pole

$60, sectioned, open-stub aluminum half-wave, dual-band J-pole antenna

by Stan, KJ7BDV and Kent, N7EKF (email skantenna@yahoo.com for info or call 801-372-7260)

Complete antenna breaks down into a compact 2″ x 6″ x 12″ package weighing only 3 lbs, perfect for backpacking and portable work where you really need a good 2-meter antenna

HamBadgers

Amateur radio name badges and other products

$10, official UVARC ham radio name badge with the club logo

Visit Ham Badgers and select Ham Radio Clubs > Utah Valley Amateur Radio Club

Email Eric Palmatier at hambadgers@gmail.com or call 919-249-8704

Where everybody knows your call sign

Utah Valley Amateur Radio Club
PO Box 1288

K7UVA
Phone/Text: 801-38-1865
Email: k7uva@arrl.net

Repeaters: 146.780–, 100.0
448.200–, 100.0 224.560–, 100.0
145.250-, 100.0 448.225-, 100.0
Newsletter input?
Email uvarcshack@gmail.com
Need help?
Email uvarcelmer@gmail.com

[See all our newsletters on uvarc.club]

We are the *Utah Valley Amateur Radio Club*, a 501(c)(3) non-profit (EIN 81-360-6416) Utah corporation that was organized in an obscure Orem fire station on 02-05-2016 to provide amateur radio enthusiasts in Utah County and surrounding areas a way to gather and discuss all things ham. Our primary purposes are to provide a local amateur radio resource, help new hams in their new-found adventures, and to give more experienced hams a reason to share their wealth of knowledge and wisdom in a friendly atmosphere of fellowship. We're an ARRL Affiliate and work in cooperation with the Utah VHF Society, but are not subsidiary to them, to ARRL, ARES, or any other organization, although many of our members and leaders might also belong to the same.

This newsletter is copyrighted and published by the Utah Valley Amateur Radio Club, and its purpose is to convey the tone and temperament of the club, to inform and entertain its members, and to entice the rest. To join, go to uvarc.club/join, then sign up at www.facebook.com/groups/uvarc/ to stay informed. For more information about our club or about amateur (ham) radio in general, please email or text or call us.

More than just a club, we invite you to become part of a great ham radio movement in Utah Valley

Our fearless leadership

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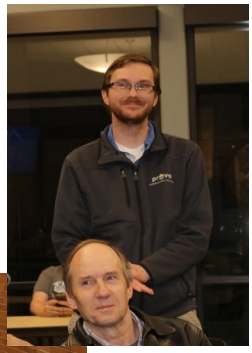
From all of us to you, 73